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(54) Hazzard or security monitoring device

(57) Hazzard or security monitoring circuitry is located in a housing (2), (Figure 1), having at one end a connector (3) for insertion into a standard lamp socket 52 and at its other end a socket (4) to receive a lamp 53. The monitoring circuitry may be activated by turning a wall switch 54 for the lamp 53 off then back on again within a predetermined period, the lamp 53 also then being energised at half strength. A fire, gas or smoke detector may signal to one or more remote receivers 51 by signals superimposed on the main supply, via a light or infra-red beam, via radio, or via an induction loop, (Figure 4). In a system for a hospital, the detector (71), (72), (Figure 4), may operate a remote timer (79) which activates a main alarm system unless a cancel buttin (77) is operated with a predetermined time to acknowledge the alarm signal.

The circuitry in the housing may alternatively include a motion detector for sensing an intruder, (Figure 5).

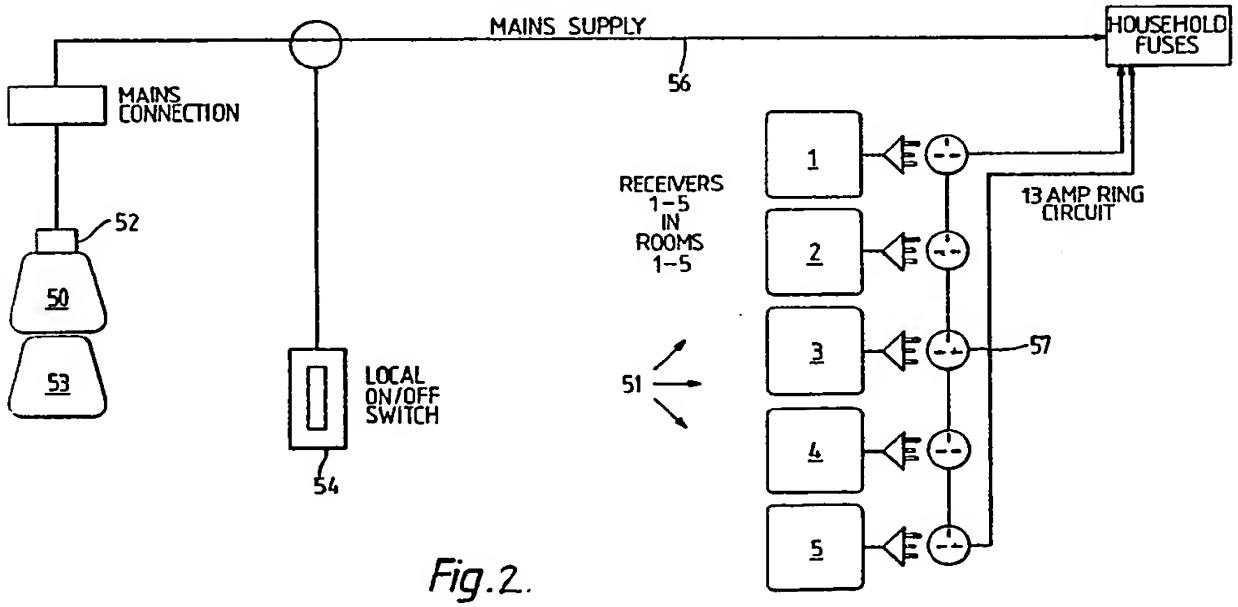

Fig.2.

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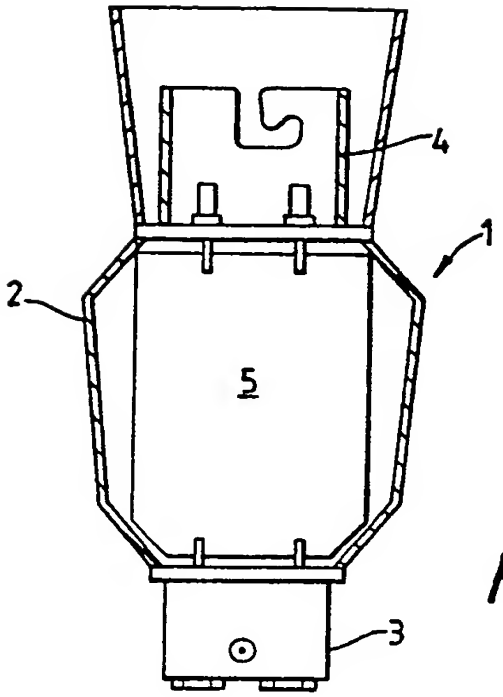

Fig.1.

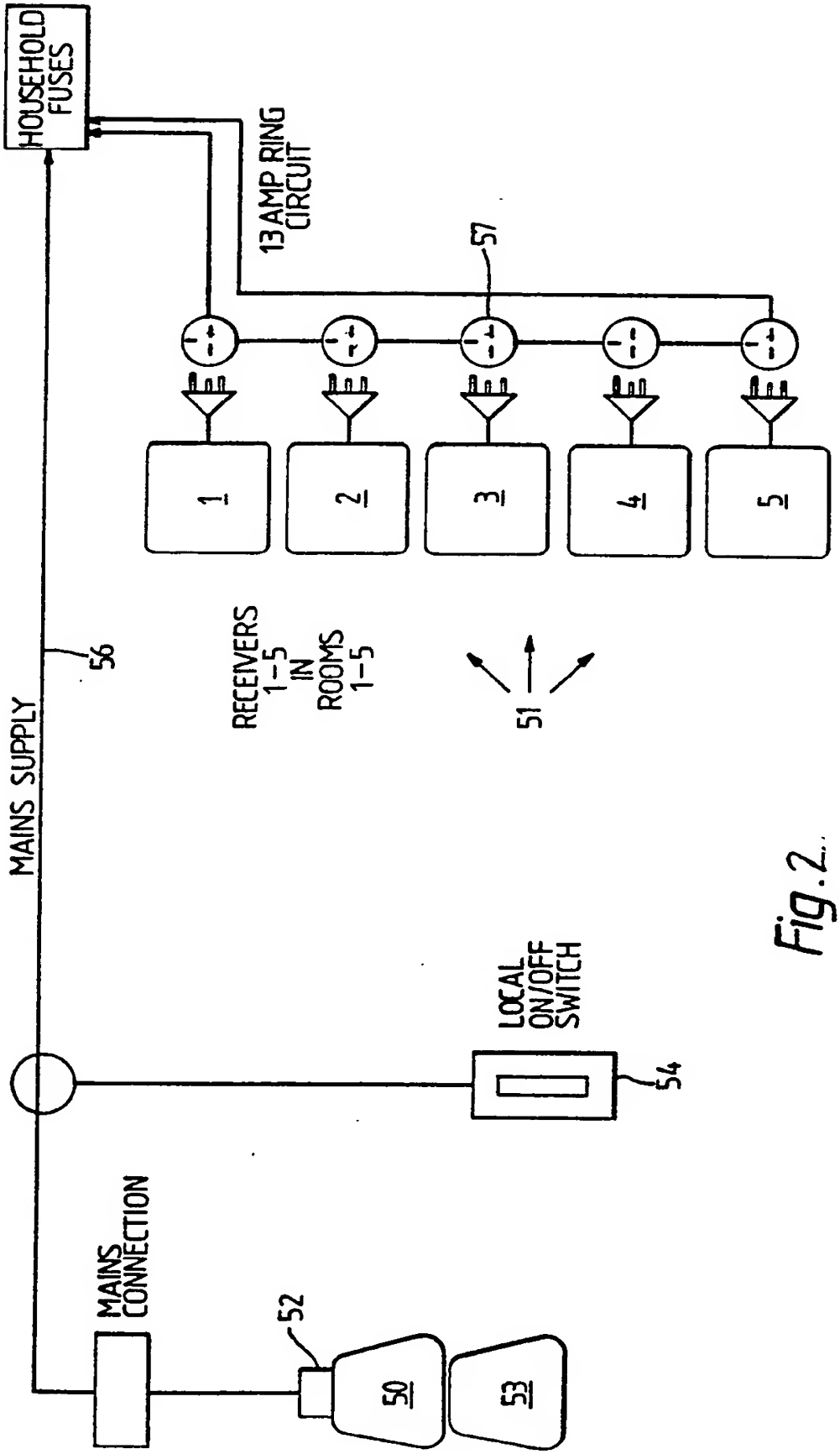

Fig. 2.

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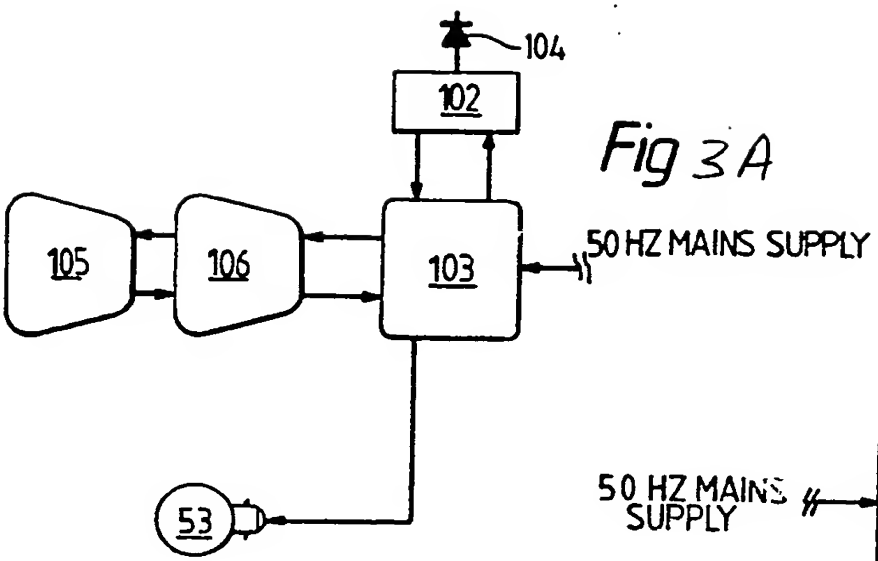


Fig 3A

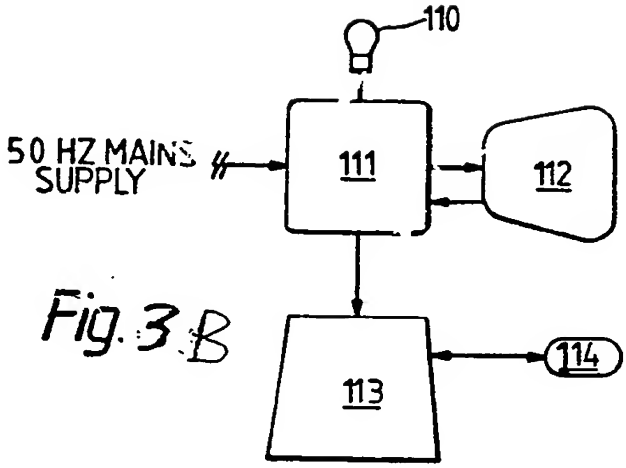
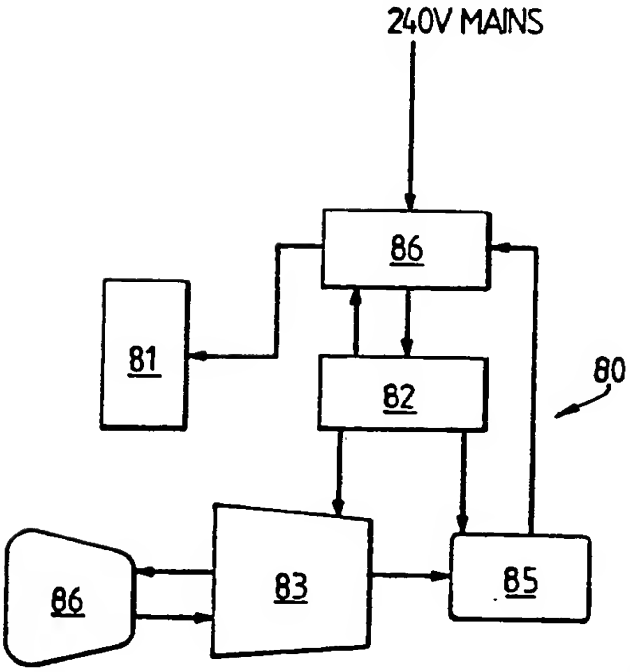


Fig. 3B



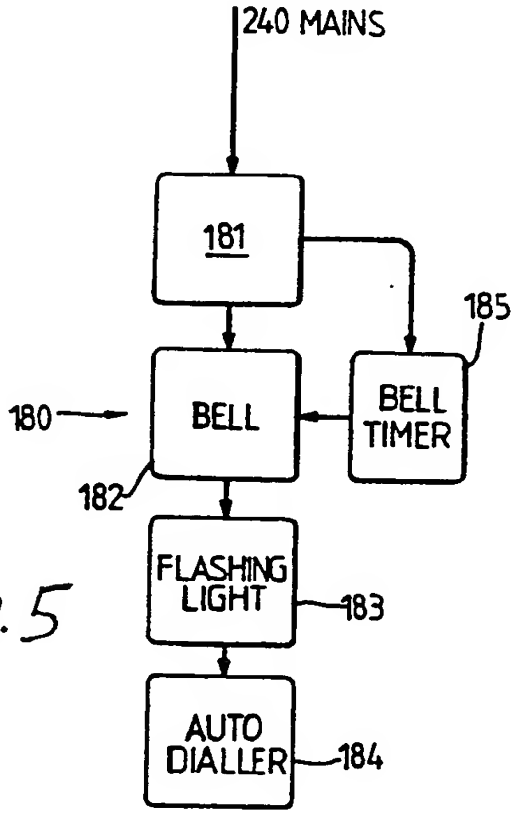


Fig. 5

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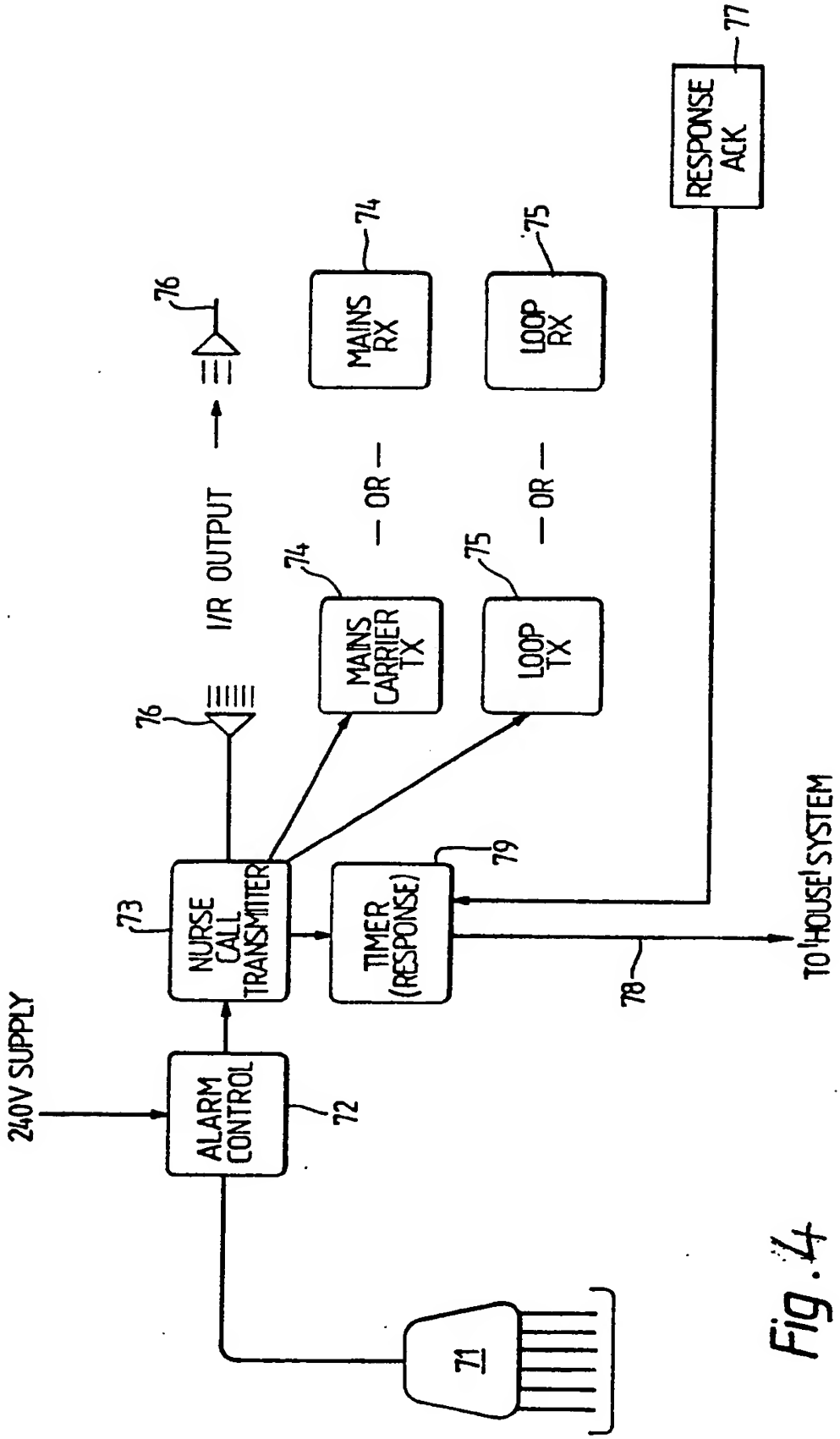

Fig. 4

SPECIFICATION

Electrical devices

The present invention relates to a electrical device and, more specifically, to electrical devices which perform monitoring/alarm functions.

According to a first aspect of the invention, there is provided an electrical device comprising a body adapted to be interposed between a light and a light socket, the device containing circuitry for monitoring a security condition or hazzard condition in the environment in which the device is located.

The device may house a fire, gas or smoke detector and the circuitry be arranged to provide a signal exteriorly of the device when fire or smoke is detected; the detector may be sensitive to a particular gas or gases so that, for example, the device can be used to detect the presence of poisonous or otherwise dangerous gases in the atmosphere.

The device may be used in association with a remote alarm or relay device or similar to which it transmits signals in any one of a number of suitable ways, for example, by an infra red transmitter/receiver link or by signals modulated onto the mains waveform at the detector and transmitted via the mains wiring to the remote device. According to the particular application in question, this remote device may serve a number of functions, for example providing visual and audible warnings e.g. by operating conventional fire alarm devices and/or to transmit the state of the monitored condition or an alarm signal to a location off site e.g., by use of an automatic telephone dialler.

Where, in any of the aspects of the invention, it is desired to have the device operable in a number of modes, the device may contain circuitry to facilitate the change in mode without having to provide additional wiring or devices to control the device. Thus, for example, the circuitry may comprise circuitry responsive to the presence of a mains voltage applied to the device for selecting the mode of operation, for example the desired mode of operation may be initiated by turning the light switch associated with a light socket on, then briefly off then on again, the circuitry responding to this sequence to set up the desired mode of operation.

The invention will be further described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a schematic sectional view of the housing of the device used in the embodiments of Figures 2 to 5;

Figures 2 and *3A* and *3B* are schematic block diagrams of a fire alarm incorporating an embodiment of the present invention;

Figure 4 is a schematic block diagram of a fire detection system incorporating a fifth embodiment of the present invention;

Figure 5 is a schematic block diagram of a fire alarm system incorporating a sixth embodiment of the present invention;

Figure 1 shows in section the housing used in the devices of Figure 2 to 5. The housing comprises a body 1 of, say, plastics material having, at one end, a standard bulb fitting 4 such as a bayonet and at its other end a corresponding socket 3 whereby the device may be interposed between an existing light bulb and socket. The device is preferably of relatively short length so that it does not place the bulb so far forward as to contact any cover or the like with which the bulb may be provided. The device 1 incorporates a circuit board 5 incorporating circuitry 10 which performs a security or hazard monitoring function.

Figures 2 and 3A and 3B show the forms of fire or smoke detection systems incorporating devices embodying the present invention.

There are currently many smoke detection devices available which employ low drain standby current consumption from an internal battery. The life expectancy of this internal battery depends very largely on the construction of the cell having due regard for the electrolyte and the internal resistance of the cell. Relying on a battery based system is not satisfactory unless the detector is regularly checked.

Alarms intended primarily for the domestic market tend to have a rather high false alarm rate. During the course of the day in the average home a variety of other quite normal activities can result in the detector going into alarm condition e.g. cooking, painting and entertaining. In general this problem is not one of location of the detector, for plainly it is monitoring the air and it works. Neither is it one of sensitivity for there is an atmospheric change to be detected.

Additionally the detector, whilst active during the time that the household is most vulnerable is unable to arouse the sleeping occupants because the warning note from the detector is usually required to pass through at least one closed door on its way to the sleeper. Installations in Hotels and Guest Houses are required to have bells or warning devices which are clearly audible from the inside of each individual hotel room with all the corridor fire doors closed and the room door secured.

The embodiment of the invention shown in Figure 2 used a detector in accordance with the present invention in a fire alarm system also comprising a number of receiver/alarm units 51.

The device 50 is fitted into light socket 52 after removal of the lamp 53 from the holder of the ceiling fitting in which it is to be used and the lamp 53 is then replaced.

The circuitry in device 50 is so arranged that when the fire detection function is not required, the lamp can be operated normally from the existing wall switch 54. The circuitry 101 (Figure 3A) within the device 50 includes a circuit 102 for monitoring the incoming mains supply and a circuit 103 for deriving low voltage DC for use by the device 50 and for controlling the AC mains voltage applied to the bulb 53. In the normal, non-detection mode, the circuit 103 permits the mains supply to the bulb 53 to be controlled by the wall switch 54. To activate the detection mode, the user operates the wall switch 54 so that the bulb 53, assuming it is already switched on, is rapidly switched off then on again. This would normally be done by the last person retiring that evening and the circuit 102 is suitably designed to detect this switching pattern of the incoming mains and, in response to detecting it, to enter the detection mode.

The device 50 acknowledges this instruction by the circuit 102 causing an LED 104 to illuminate on the body of the device and the circuit 103 causing the lamp 53 in its holder to glow at approximately half strength.

At this point convection currents generated by the heat from the bulb 53 causes the air locally to be convected into ventilation holes (not shown in Figure 1) in the body 1 of the device 50. Once inside the air is channeled into a small conventional ionisation chamber 105 where the content of the air is examined.

In the event of the chamber 103 detecting a combustion gas content and triggering an alarm condition, this condition is not made by an on board device or sounder. Instead a circuit 106 which is a mains connected coded carrier generator produces a signal to be superimposed on the mains. This coded carrier generator or transmitter causes a small, around 2mW transmission, at approximately 250khz to be introduced onto the mains wiring 26 to which the device is connected.

In each of the rooms occupied by the sleeping persons there is plugged one of the receivers 51. Each of these receivers is connected to a mains socket 57 and carries an illuminating lamp 110 to indicate connection. Internally the circuitry 112 of the receiver is designed to continuously monitor the incoming mains.

When the incoming means carried the coded transmission from the detector 50, the circuit 112 detects its occurrence and signals the circuitry 111 of the receiver to activate an alarm sounder 113.

On investigation of the cause of the alarm each of the remote bedside receivers can be reset by means of a simple low-profile button 114. The system is then active and until required again will remain quiescent. In the morning the system can be restored to normal 'no detection' working by simply switching off the light into which the detector 50 is plugged.

Thus by the single strategically placed detector, a number of separate highly audible sounders can be activated in five individual areas inside the building each with their doors shut and at some distance from the detector.

Figure 4 shows a further form of smoke or fire detector for use in applications such as hospital wards. Conventional smoke, combustion gas or similar early warning systems are extremely prone to false alarm calls due mainly to the concentrated levels of air-bourne vapourised liquids, e.g. ether, used in the normal course of the hospital's activity.

The embodiment of Figure 4 is intended to provide a single and cost-effective means of reducing problems associated with hospital-type environments.

In the system according to Figure 4 each ward and other area to be monitored is fitted with a detector transponder (70) similar to the detector 50 of Figures 2 and 3.

This detector 70 is used place of the normal ward monitoring equipment. In operation the system uses an ionisation chamber 71 in the detector 70 to monitor the air and vapours air bourne in that vicinity. In the event of an alarm condition being detected the system alarm control circuit 72 energises a transmitter 73 to signal the duty ward sister who would normally be in attendance of the fact. She would then investigate the cause and should the occasion demand so break the local break-glass contact to formalise a call on the house system to summon the local fire brigade.

In essence the evaluation of threat from any given alarm would be the duty of the ward sister or staff nurse and the decision as to whether or not to call the local services would be her responsibility.

In responding to the alarm warning the duty sister would be required to acknowledge receipt of the call by depressing a button within a specified period of time, failing which the secondary system would automatically default to a normal main alarm alert.

The system of signalling to the duty sister would be by means of either a mains transponder 74 (as in Figures 2 and 3), an induction loop transmitter 75, an infra-red transmitter 76 or a similar device to activate a corresponding receiver (74', 75', 76') which she would normally be expected to carry about her person.

On signalling of an alarm condition, a timer 49 is activated and unless the condition is cancelled by the nurse pressing a cancel button 77 or similar arrangement before the timer times out a signal is sent via line 78 to the main alarm system capable of signalling direct to the emergency services.

In this manner all alarms would be dealt with locally and the incidence of false alarm virtually eradicated. Only genuine emergencies would result in the attendance of the emergency services but with the safety override that should an emergency crop up where the sister was completely occupied coping with it and either unable or forgetful to call for assistance then the system would automatically do so when the timer 79 times out at the expiry of the response period.

Figure 5 shows a security alarm system incorporating a device 80 according to the present invention and intended to provide a low cost user-installable system generally for use in a wide range of operational conditions.

The user installs the device 80 into a lamp socket nearest to the desired point of exit from the premises and inserts the previously removed bulb into the socket 81. On leaving the protected premises, to arm the device the owner switches on the lamp by using the normal wall switch then turns it briefly off, then on again. This switching pattern is detected by a mains interrupt sensor circuit 82 which activates an alarm module 83 which responds by emitting an audible note for say, 25 seconds during which time the owner vacates the premises; the alarm module incorporates a timer circuit to define this delay. When, at the end of this 25 second period the timer circuit times out alarm module goes automatically into the guard mode. In the device 80, a security condition sensor 84 such as a conventional infra-red motion detector monitors the security condition. If at any time during operation the detector detects an abnormal security condition e.g. movement is detected, the alarm module 83 waits, say 25 seconds and then triggers into operation an alarm signal transmitter 85 which may, as shown be a mains carrier transmitter which injects a high frequency coded signal

onto the mains supply via the devices power supply unit. This signal is picked up by a remote alarm unit 180 which may be plugged into a mains socket and which incorporates a circuit 181 to monitor the mains supply and detect and decode the alarm signal. The circuit 181 may trigger one or more alarm devices such as a bell 182, a flashing light 183 and a telephone auto dialer 184. The auto dialler may be preset or keyed to call any selected number and transmit a recorded voice message or, e.g. an electronic alarm code. The number called might well be the telephone number of the person being visited on this occasion.

Once activated the external alarm warning bell 183 will ring for a period of 30 minutes as determined by a bell timer 185 and then re-set automatically. The bell 183 may be located within the unit 180 or, more usually, be fitted exterior to the premises.

On his return the owner entering through the front door will pass into the protected area and immediately initiate the warning tone. He will then have 25 seconds to disarm the system. One way that the device 50 can be arranged to achieve this is to design the circuitry so that switching off the lamp for approximately ten seconds causes the device to cancel any alarm about to be triggered and cause the lamp to revert to normal operation. If desired the lamp switch could be key operated to provide a greater measure of security. A variety of supplementary devices could be introduced into the controlled network giving even wider domestic protection. For example additional detectors on doors or windows intruder motion detectors in other remote areas. Specific asset protection could be provided e.g. for paintings, cups, medals, items of sentimental value, even drawers or wardrobes. With other sensors a fire hazard warning could be introduced with an alternative telephone message or differing external warning note or flashing sign expansion.

CLAIMS

1. An electrical device comprising a body adapted to be interposed between a light and a light socket, the device containing circuitry for monitoring a security condition or hazzard condition in the environment in which the device is located.

2. A device according to claim 1, wherein the circuitry includes a smoke gas or flame detector.

3. A device according to claim 2, wherein the detector comprises an ionization chamber.

4. A device according to claim 2 or 3 wherein the circuitry is arranged to produce an alarm signal when the detector detects smoke, gas or flame in excess of a predetermined level.

5. A device according to any one of claims 1 to 4 wherein the body contains an intrusion detector.

6. A device according to claim 5, wherein the intrusion detector is a radar, ultrasonic or infra-red detector.

7. A device according to any one of claims 1 to 6 wherein the circuitry is arranged so that its operation is armed by the pattern of energisation of the mains supply to the socket.

8. A device according to claim 7, wherein the circuitry is arranged to detect a predetermined pattern of on and off periods of the mains supply.

9. A device according to any one of claims 1 to 8, wherein the device is arranged to transmit to a remote receiver a signal representative of said condition.

10. A device according to claim 9, wherein the device is arranged to transmit the signal via a light or infra-red beam or via radio.

11. A device according to claim 9 or 10 wherein the device is arranged to transmit the signal via a link comprising an induction loop.

12. A device according to claim 9, wherein the device is arranged to transmit the signal via the mains supply to said socket.

13. A device according to claim 12, wherein the device includes a means for superimposing said signal as a high frequency signal onto the mains supply waveform.

14. A device according to any one of claims 9 to 13 in combination with at least one receiver, the or each receiver containing circuitry for detecting and responding to the security- or hazard-condition.

15. A combination according to claim 14, wherein the or each receiver contains means for generating an alarm signal.

16. A combination according to claim 15, wherein the alarm signal generating means includes an automatic telephone dialer for setting up a telephone call to send an alarm message.

17. A combination according to claim 14 or 15, wherein the or each receiver includes a timing arrangement adapted to be set into operation on detection of a security or hazard condition, means for generating a personal alarm signal to alert a user of the condition and means for generating an alternative alarm signal after a period determined by the timing arrangement if the user has not responded to the personal alarm.

18. A combination according to claim 17, wherein the alternative alarm signal is a general alarm.

19. A device according to any one of claims 1 to 13 or a combination according to any one of claims 14 to 16 wherein the monitoring circulating is arranged to be armed by sensing a predetermined series of on and off periods of the mains supply to the device.

20. An electrical device according to claim 1 constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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